

SECTOR ASSESSMENT (SUMMARY): ENERGY¹

1. Sector Performance, Problems, and Opportunities

1. Cambodia's economy grew at an average rate of 7.0% from 2006 to 2016, with poverty falling substantially from 47.8% in 2007 to 14.0% in 2014.² Nonetheless, Cambodia's gross domestic product per capita, estimated at \$1,427 in 2017, remains among the lowest in Asia. An underdeveloped energy sector is a key constraint to the further improvement of Cambodia's economic competitiveness and the welfare of its people. Annual per capita consumption of electricity in the country is low—400 kilowatt-hour (kWh) in 2016—while nearly 5 million of the country's 15.44 million residents lack access to electricity and must rely on batteries and traditional fuels such as wood for energy. The country's high electricity tariff renders access to power by the poor unaffordable, while constraining economic competitiveness and discouraging investment. Recognizing that expanded access to modern and affordable forms of energy is essential for Cambodia's social and economic advancement, the government's National Strategic Development Plan (NSDP), 2014–2018, and Industrial Development Policy (IDP), 2015–2025 prioritize the need to affordably and sustainably develop the energy sector, while also considering the need to minimize adverse environmental and social impacts.³

2. Cambodia's energy sector faces several strategic challenges: access to energy is the most pressing challenge in the short and medium term, while broader and longer-term issues of energy security, affordability, and environmental sustainability also need to be addressed. Expanded infrastructure—including cost-effective power plants, transmission lines, and distribution networks, are needed to bring modern energy services within reach of the entire population. For improved energy security, diversification of energy sources, particularly through the use of renewable resources, such as solar energy, and limiting import dependence on coal and other fossil fuels, are necessary to reduce the impact of future increases in global fuel prices. An increased emphasis on energy conservation is also needed to constrain demand growth.

3. **Primary energy.** The primary energy supply in Cambodia totaled about 4.8 million tons of oil equivalent in 2015.⁴ Fuel wood and other biomass accounted for about 44.4% of the total, oil and petroleum products for 38.5%, coal for 10.7%, hydropower for 3.6%, and electricity imports for 2.8%. Cambodia's energy use of about 480 kilograms of oil equivalent per capita per year in 2016 was about 65% of the average in Asia of 740 kilograms, according to the International Energy Agency. Given continuing population and economic growth, and increased urbanization, the Asian Development Bank (ADB) predicts that the country's energy needs will double by 2030.

4. **Fossil fuels.** Cambodia imports all fossil fuels that it consumes, including coal and oil. Preliminary estimates for coal deposits are small (about 7 million tons), and no commercial-scale mining has begun. Cambodia also has very limited ongoing exploratory oil drilling and no refineries. The country has untapped and mostly un-quantified potential for petroleum extraction, although several geological factors point to the potential that oil and gas extraction may be viable. Cambodia is drafting laws and regulations regarding oil and gas production to update the current legal framework. Future demand for oil will be driven primarily by the demand for diesel and gasoline, as

¹ This summary is based on ADB. 2018. *Cambodia Energy Sector Assessment, Strategy, and Road Map*. Manila.

² Country Economic Indicators (accessible from the list of linked documents in Appendix 2 of the report and recommendation of the President); ADB. 2018. *Basic Statistics 2018*. Manila.

³ Government of Cambodia. 2014. *National Strategic Development Plan 2014–2018*. Phnom Penh; Government of Cambodia. 2015. *Cambodia Industrial Development Policy 2015–2025: Market Orientation and Enabling Environment for Industrial Development*. Phnom Penh.

⁴ Government of Cambodia, Ministry of Mines and Energy, and Economic Research Institute for ASEAN and East Asia (ERIA). 2016. *Cambodia National Energy Statistics 2016*. Jakarta: ERIA.

the country becomes more motorized and as the government promotes industrial zones for manufacturing and agro-processing.

5. **Renewable energy.** While large hydropower generation represented 52% of total electricity generation capacity, or 980 megawatts (MW) out of a total of 1,878 MW in 2017, Cambodia's other renewable generation was relatively limited, representing about 30 MW of capacity and consisting mainly of on-grid biomass (sugar-bagasse), rice husk biomass gasification, and off-grid solar home systems, installed by the Rural Electrification Program (REF) and administered by Cambodia's national electricity utility, Electricite du Cambodge (EDC). The government, with support from the development partners, began serious consideration of solar energy in 2013, when a technical study by the Korea Photovoltaic Industry Association helped investigate the scope for development of a 100 MW solar power plant in Cambodia.⁵ In 2015, a United States Agency for International Development-funded study explored the viability of using various solar energy applications to enhance Cambodia's energy security.⁶ More recently, the government has explored solar power as a generation option because of the rapid reduction in global prices for renewable technologies such as solar, Cambodia's excellent solar potential, and the country's ratification of the Paris Agreement, negotiated at the 2015 United Nations Climate Change Conference. In February 2016, the government issued its first large-scale tender for solar technology, inviting bids for the supply of 10 MW in Bavet in Svay Rieng Province to support development of its special economic zone. Sunseap Group, financed by ADB's Private Sector Operations Department, constructed the project, which was commissioned in October 2017. ADB estimates that Cambodia's wind energy potential is relatively low at about 18–72 MW.

6. Cambodia was invited to be a pilot country under the global Scaling Up Renewable Energy Program in Low Income Countries (SREP) (part of the Climate Investment Funds) in 2014. In August 2017, a \$14 million SREP investment plan that provides for a combination of grants and concessional loans for the Cambodia National Solar Park Project was approved. ADB is the sole implementing partner for the SREP investment plan. Given ongoing rapid declines in the price of solar technology, the SREP investment plan will focus on promoting solar uptake in Cambodia, with some additional policy support.

7. **Sector structure.** The Ministry of Mines and Energy develops government policy, strategies and plans for the energy sector. The Ministry's General Department of Petroleum is responsible for regulating oil and natural gas exploration and production, and the wholesale and retail sales of petroleum products. The Ministry of Economy and Finance, as co-owner of EDC, facilitates EDC's access to long-term and concessional finance. The Ministry of Environment is responsible for reviewing and approving the environmental assessments and environmental management plans for all energy projects. The Electricity Authority of Cambodia (EAC), the electricity regulator, is an autonomous agency responsible for issuing rules, regulations, and procedures on power market operations; awarding licenses; and setting tariffs. EDC, as the state-owned, vertically-integrated power utility, generates, transmits, and distributes electricity in areas assigned to it by EAC. The REF is the governmental body responsible for subsidizing rural electrification and was integrated into EDC in August 2012. The promotion of private participation in electrification, including rural electricity enterprises (REEs),⁷ is mandated by Cambodia's 2001

⁵ Korea Photovoltaic Industry Association; KC Cottrell Co., Ltd.; and Sun Business Development (for ADB and the Government of the Republic of Korea, Ministry of Trade, Industry, and Energy). 2013. *Pre-feasibility Study in the Kingdom of Cambodia: Identification of Feasible Sites and Conditions for the Development of 100 MW Photovoltaic Power Project*. Unpublished.

⁶ R. de Ferranti et al. 2016. *Switching On: Cambodia's Energy Security in a Dynamic Technology Cost Environment*. Phnom Penh: Mekong Strategic Partners.

⁷ The REEs have been an important private-sector resource for developing, operating and maintaining the country's electricity distribution network.

Electricity Law. In addition, private domestic and foreign investors are encouraged to invest in (i) oil and gas exploration and production, (ii) energy generation from various energy resources, and (iii) the high-voltage transmission system.

8. **Electricity subsector.** Prior to 2010, Cambodia's power generation capacity was almost entirely based on diesel generators. From 2011 to 2017, total installed capacity increased significantly and became more diversified with hydro, coal, and solar projects being commissioned. At the end of 2017, the EAC reports that the total domestic installed capacity was 1,878 MW, including hydropower (980 MW, or 52%), coal-fired (564 MW or 30%), diesel (295 MW or 16%), biomass (29 MW or less than 2%), and solar (10 MW, or less than 1%).⁸ Annual power consumption in 2017 was 8,073 gigawatt-hour (GWh). Power imports, which have traditionally been a significant source of power to meet domestic demand, have been reduced. In 2017, imports from Viet Nam were 1,095 GWh, down from 1,177 GWh in 2016, and imports from Thailand were 291 GWh in 2017, down from 336 GWh in 2016. A small amount of power is also imported from the Lao People's Democratic Republic (Lao PDR) to serve the border areas. The 2015 Power Development Plan (PDP) base-case scenario projects annual electricity demand will triple from 2015 levels by 2030, reaching 18,000 GWh.⁹ The development of large hydropower and coal plants is increasingly facing opposition from local communities and civil society, and the government has established a moratorium on the construction of new hydropower dams until 2020.

9. Cambodia has had a fully integrated high-voltage transmission system in place since 2015. The national grid is interconnected to Viet Nam synchronously via a 230-kilovolt (kV) line in the southeast. Cambodia also relies on power supplies from Thailand in the northwest and from the Lao PDR in the northeast via separate 115 kV links. The national grid supplies electricity in 19 of 25 provinces in Cambodia via 30 substations. Additional medium-voltage supply is available in several areas along the border through extension of 22 kV lines from the Vietnamese, Thai, and Lao grids. The concerted expansion of the high-voltage transmission system and the medium-voltage sub-transmission system have enabled an increasing number of REE licensees to connect to the grid supply, thereby improving supply quality. Cambodia's PDP entails expanding the transmission network by about 2,600 kilometers to connect the remaining provinces to the national grid. Cambodia's transmission grid development is also essential for creating an integrated power market in the Greater Mekong Subregion, which is a common goal of the Greater Mekong Subregion countries.

10. **Pricing.** Electricity has traditionally been very expensive in Cambodia, and prices are generally higher in rural areas than in towns and cities. The reduced reliance on diesel and imports and grid extension are reducing the cost of supply. In 2015, the government introduced a subsidy program to reduce the electricity tariff during 2016–2020 for areas supplied from the national grid. Since 2016, the tariff for customers that consume less than 10 kWh per month is KR480 per kWh (or about \$0.12 per kWh), and KR610 per kWh (or about \$0.15 per kWh) for customers that consume less than 50 kWh per month. The current retail tariff for those consuming more than 50 kWh per month in and around Phnom Penh is KR720–750 per kWh (about \$0.18–\$0.19 cents/kWh).¹⁰

11. **Constraints.** The key sector constraints in Cambodia are (i) grid fragmentation, which prevents the seamless transfer of power and creates tariff imbalances between urban and rural

⁸ Electricity Authority of Cambodia. 2018. *Report on the Power Sector of the Kingdom of Cambodia, 2018 Edition*. Phnom Penh.

⁹ Chugoku Electric Power Co., Inc. 2015. *The Project on Revision of Cambodia Power Development Master Plan*. Presentation prepared for the Government of Cambodia. Phnom Penh. September. Unpublished.

¹⁰ In comparison, in 2011, prices for households typically ranged from \$0.30 to \$0.80 per kWh, but in the countryside, prices varied between \$0.65 and \$0.90 per kWh.

areas; (ii) heavy reliance on planned new coal-fired power dependent on coal imports, and large hydropower with attendant environmental and social problems; (iii) lack of financial capacity for grid development, which challenges EDC's financial sustainability and also affects REEs; (iv) limited access and lengthy waiting times for connections to reliable electricity supplies, which restricts the development of new economic growth engines, such as agro-processing, tourism, and light manufacturing; and (v) limited institutional and human resource capacity in government institutions to develop needed sector strategies, policies, processes and procedures. The government's sector strategy and assistance from ADB and other development partners aim to address these constraints to support sustainable economic growth.

2. Government's Sector Strategy

12. Cambodia lacks a comprehensive energy strategy, and the government's priorities for the sector are instead elaborated in broader economic strategy documents. The government's national strategy for growth, set out in the Rectangular Strategy Phase III (2013–2018), and NSDP (footnote 3),¹¹ highlights that while the significant expansion in the energy sector has been achieved, there is a greater need to build more low-cost electricity generation capacity and transmission and distribution networks. The government's Rectangular Strategy, Phase IV (2018–2023), highlights increased investment in solar energy to reduce electricity costs and ensure long-term energy security.¹² The government's strategy also highlights the importance of private sector investments in energy infrastructure and the efforts to limit the negative environmental and social impact of energy projects. Similarly, the government's IDP (footnote 3) recognizes that insufficient coordination and investment in physical infrastructure, such as electricity and clean water, are holding back the adoption of manufacturing and other value-added industries. The plan calls for the government to reduce the price of electricity for targeted industrial zones and expand transmission coverage and improve supply reliability by the end of 2018. The IDP also calls for a review of the forecast of long-term electricity demand, the PDP, and energy supply options. With regards to rural electrification, the government aims to provide electricity to all villages by 2020.

3. Asian Development Bank Sector Experience and Assistance Program

13. ADB's current country partnership strategy (CPS) for Cambodia, 2014–2018, reflects the priorities set up in the Rectangular Strategy Phase III and NSDP.¹³ The CPS is focused on two strategic pillars: (i) rural-urban-regional linkages, and (ii) human and social development. Public sector management acts as a facilitating cross-cutting strategic pillar. The energy sector directly supports outcomes under the first pillar, which helps address a number of challenges also addressed in the IDP: industrial transformation; competitiveness; value chain promotion, including in the agriculture sector; rural energy and sustainable rural job creation; urban and rural infrastructure along national and subregional economic corridors and rural arteries; and related logistics improvements.

14. Since 1999, ADB has approved seven energy sector project loans to Cambodia for a total of \$166 million, or 11% of total cumulative ADB loans to Cambodia. ADB's ongoing sector efforts have primarily focused on expansion of the grid into rural areas. The most recent and ongoing projects include: (i) financing of 2,110 circuit-kilometers of 22 kilovolt sub-transmission lines and

¹¹ Government of Cambodia. 2013. *Rectangular Strategy Growth, Employment, Equity and Efficiency, Phase III of the Royal Government of Cambodia of the Fifth Legislature of the National Assembly*. Phnom Penh.

¹² Government of Cambodia. 2018. *Rectangular Strategy for Growth, Employment, Equity and Efficiency: Building the Foundation Toward Realizing the Cambodia Vision 2050, Phase IV of the Royal Government of Cambodia of the Sixth Legislature of the National Assembly*. Phnom Penh.

¹³ ADB. 2014. *Country Partnership Strategy: Cambodia, 2014–2018*. Manila.

household meters in five provinces, including a grant component to REF to finance connection costs for poor households¹⁴; and (ii) extending medium- and low-voltage networks in Svay Rieng, promoting higher efficiency cook stoves in Kampong Cham, and building the capacity of EAC¹⁵. During 2016–2018, ADB developed a national solar photovoltaic grid integration study and roadmap for EDC.¹⁶

15. Interventions by other development partners. Several development partners are active in the energy sector in Cambodia. Export credit agencies from the People's Republic of China are supporting large generation projects. The Japan International Cooperation Agency, Agence Française de Développement (AFD) and KfW support expansion of medium-voltage and high-voltage transmission lines. In terms of technical assistance, the World Bank has recently completed an energy access review, while the Japan International Cooperation Agency is supporting capacity development activities aimed at strengthening power and transmission system management, planning, and procurement within the National Control Center of EDC. AFD has commissioned a grid modernization study. AFD and the government of Australia also continue to support the deployment of solar home systems for households in rural areas.

16. ADB lessons. Affordable electricity tariffs are critical for achieving the government's rural electrification goals and improving the country's economic competitiveness. EDC must continue to expand transmission and distribution networks to connect more licensees. With the ongoing reduction in renewable energy generation costs, and abundant renewable energy resources, Cambodia is well placed to integrate significant amounts of renewable energy, particularly solar, into its generation mix. Diversifying Cambodia's hydropower and coal base load supply through the addition of solar power would help lower cost of supply, while also helping reduce emissions from the power sector. It is also imperative that Cambodia develop a consolidated sector strategy to help guide energy programs and investments.

17. Future ADB support. ADB is adapting to evolving requirements in Cambodia's energy sector, particularly the country's commitment to a clean energy transition, with the provision of reliable, affordable, and sustainable energy for all. ADB's sector strategy, which will be integrated into the CPS, 2019–2023, and aligned with ADB's Strategy 2030,¹⁷ includes supporting the government to increase the sustainability and affordability of the generation mix through the development of clean energy sources and to improve supply reliability through grid strengthening. Through the proposed project, ADB will support EDC in developing a 100 MW capacity solar park and tendering development of the first solar generation plant in the solar park to the private sector through transaction advisory support from ADB's Office of Public–Private Partnership. It is expected that EDC will set up additional solar parks in the near-term, drawing on the solar generation roadmap prepared by ADB (footnote 16). ADB is also planning an investment project for 2020 to support upgrades and expansion of a series of transmission lines and substations in Phnom Penh and Sihanoukville to strengthen the power transmission network. ADB is also preparing a technical assistance project to (i) help the government develop a new long-term energy strategy and power development plan; (ii) provide related capacity development; and (iii) prepare a pipeline of investments, some of which may be considered for ADB financing under the new CPS.

¹⁴ ADB. 2012. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Administration of Loan to the Kingdom of Cambodia for the Medium-Voltage Sub-Transmission Expansion Sector Project*. Manila; ADB. 2016. *Additional Financing for the Proposed Administration of Grant to the Kingdom of Cambodia for the Medium-Voltage Sub-Transmission Expansion Sector Project*. Manila.

¹⁵ ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Administration of Grant to the Kingdom of Cambodia for the Rural Energy Project*. Manila.

¹⁶ Both documents were prepared by ADB on a confidential basis for EDC.

¹⁷ ADB. 2018. *Strategy 2030: Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and the Pacific*. Manila.

PROBLEM TREE

